DOI: 10.1111/jdv.17129 JEADV

ORIGINAL ARTICLE

Lesion-directed screening to optimize skin cancer detection in dermatology practice: an observational study

S. Mylle,[1,2,†] E. Verhaeghe,[1,2,†] L. Van Coile,[1] B. Van de Maele,[1,3] I. Hoorens,[1,2,‡] L. Brochez[1,2,*,‡]

[1]Department of Dermatology, University Hospital Ghent, Ghent, Belgium
[2]Cancer Research Institute Ghent (CRIG), Ghent, Belgium
[3]Department of Dermatology, General Hospital Sint-Lucas, Bruges, Belgium
*Correspondence: L. Brochez. E-mail: Lieve.Brochez@UGent.be

Abstract

Background Early detection of skin cancer is still a major challenge in dermatology practice today. While surveillance programs are offered to high-risk patients, systematic total-body examination (TBE) in the general population is not cost-effective. In the past, we demonstrated that a lesion-directed screening (LDS) in the general population delivered similar detection rates to TBE and was less time-consuming.

Objectives To study whether a lesion-directed early-access consultation can optimize skin cancer detection in dermatology practice.

Methods In this observational study, we offered an early-access consultation in patients contacting the dermatology department concerning 1 or 2 lesions of concern meeting predefined criteria.

Results 342 persons were seen at the dermatology department after triage by phone. Skin cancer detection rate was 13.2% (4.1% for melanoma). If advised/referred by a doctor skin cancer detection rate was 23.6% (9% for melanoma). With a history of skin cancer, detection rate was 24.3% (4.3% for melanoma). In patients with no referral and a negative history of skin cancer, detection rate was 7.7% (1.7% for melanoma), which is at least triple the rates reported by population-based screening programs. In patients in whom the index lesion was benign, worry of having skin cancer had decreased significantly by the end of the consultation. Additional total-body examination in these patients had low additional detection rate (0.5%) and a high number of unnecessary excisions (number needed to excise 13).

Conclusions An early-access dermatology consultation for LDS after triage by phone resulted in high overall skin cancer and melanoma detection rates. Our data indicate that performing TBE is especially useful if the index lesion is suspicious. In addition to surveillance programs in high-risk patients, LDS may be a way to optimize skin cancer detection in the general population and use available time more efficiently in daily dermatology practice.

Received: 19 August 2020; Accepted: 4 December 2020

Conflict of interest

None declared.

Funding sources

This research project was funded by the Innovation and Clinical Research Fund of the Ghent University Hospital. The research activities of I. Hoorens are supported by a postdoctoral fellowship of the Scientific Research Foundation-Flanders (number: 12Y2420N). The funding sources had no access to the data, no role in design and conduct of the study; no role in collection, management, analysis and interpretation of the data; no role in preparation, review or approval of the manuscript; no role in the decision to submit the manuscript for publication.

Introduction

Despite numerous efforts on primary prevention and early detection of skin cancer, its global incidence is still rapidly increasing.[1,2] Although melanoma only represents 5 to 10% of all skin cancers, it is responsible for the majority of skin cancer deaths and by this brings an important indirect cost to society.[1,3] While non-melanoma skin cancers (NMSCs) have low risk of metastatic spread, early detection can reduce surgical complexity, morbidity and direct costs.[4,5]

Early detection initiatives need to reduce mortality or at least morbidity. Several population-based skin cancer screenings have

†Equal contribution as first author.
‡Equal contribution as senior author.

been studied. Melanomas were found to be thinner when diagnosed through screening.[6–8] However, systematic screening in the general population is not considered cost-effective.[2,9,10] Surveillance in high-risk groups is common practice and a substantial amount of time in dermatology practice may be spent on this.[11–13] Although these groups have a high relative risk, they do not necessarily make the highest contribution to the absolute numbers of skin cancer in the total population. Mackie et al. reported a positive personal history in 2.5% and family history in 5–11% of patients diagnosed with melanoma.[14,15] So, there is a need for other strategies to detect skin cancer in the general population.

In the past, we demonstrated that detection rates and cost-effectiveness of a lesion-directed screening (LDS) were not inferior to that of a total-body examination (TBE).[16] The LDS was over 5 times faster, and additional TBE did not add much value if the index lesion was benign. This study evaluates whether an LDS early-access consultation can optimize skin cancer detection in dermatology practice.

Methods

Patients contacting the dermatology department concerned about 1 or 2 skin lesions meeting at least one of the criteria (changed mole, ugly duckling, non-healing lesion, new mole in an adult (>18 years old) and/or advised/referred by a non-dermatologist concerning a suspicious lesion) were offered an early-access consultation preferably within one week. To select these patients by telephone, the following questions were posed: 'Does it concern a changing mole'? 'Does it concern a mole that looks different than the others'? 'Does it concern a non-healing lesion'? 'Does it concern a new mole'? and 'were you referred or advised by a physician to consult concerning this lesion'?. Patients were always seen by a dermatologist familiar with dermoscopy. Patients were excluded if they did not meet the above criteria, were referred by a dermatologist or when the appointment did not take place within 4 weeks. From February 2017 until March 2017 and October 2017 until July 2019, 342 people participated in this consultation of which 297 gave their consent. This study was approved by the Medical Ethics Committee of the University Hospital Ghent, Belgium. All participants provided written informed consent.

Outcomes

Three outcomes were evaluated. First, the minimum detection rate, defined as the number of histologically confirmed malignant lesions divided by the total amount of patients consulting. Patients who did not give consent to use their data (n = 45) were considered diagnosed with a benign lesion. Number needed to excise (NNE) was evaluated. Missing data were not considered benign but kept out of the calculation of subgroup detection rates and NNE. Furthermore, anxiety levels were analysed.

Statistical analysis

Statistical analyses was conducted in SPSS (version 25.0, IBM). Pearson χ^2 test was used for comparison of all categorical variables. The Paired-Samples T-Test and Independent-Samples T-Test were used for continuous variables. All statistical tests were two-tailed and P-values <0.05 were considered statistically significant.

Table 1 Demographic details, and reason of consultation compared to study population characteristics in population-based screening initiatives

	Number	Percentage	Missings (No.)	Reference Hoorens et al. (%)	Reference Breitbart et al. (%)
Sex			45		
Female	194	65.3		56.2	73.6
Male	103	34.7		43.8	26.4
Education level (n = 254)			88		
Primary school	11	4.3		12.5	/
High school	76	29.9		44.7	/
Higher education	86	33.9		32	/
University	81	31.9		10.8	/
Incentive for consultation (N = 254, multiple answers possible)			88		
"The lesion looks different than my other moles"	108	42.5		/	/
"The lesion of concern has changed"	92†	36.2		/	/
"A doctor (non-dermatologist) advised me to see a dermatologist"	87	34.3		/	/
"Friends/family advised me to see a dermatologist"	45	17.7		/	/
Other reason	13‡	5.1		/	/

†Of these, 82 checked this box of the questionnaire, 10 more were added as they reported a bleeding (4), itching (4) and painful (2) lesion.
‡Reported reasons: personal history of skin cancer (n = 7); information session on skin cancer (n = 1); analysis of the lesion with a mobile app (n = 1); new lesion (n = 3); non-healing lesion (n = 1).

Table 2 Skin characteristics and risk factors for skin cancer in the study population compared with other population-based screening initiatives

	Number	Percentage	Missings (No.)	Reference Hoorens et al. (%)	Reference Breitbart et al. (%)
Skin Type (*n* = 213)			129		
I	39	18.4		6.4	/
II	126	59.0		59	/
III	45	21.2		32.9	/
IV	3	1.4		1.3	/
Number of nevi (*n* = 238)			104		
<25	124	51.9		57.3	/†
25-50	71	30.0		29.3	/†
50-100	28	10.5		10.0	/†
>100	15	6.3		3.4	/†
Presence of actinic keratosis (*n* = 237)	32	13.5	105	7.9‡	2.1‡
Presence of solar lentigines on trunk (*n* = 198)	88	44.2	144	63.7§	
Presence of atypical nevi (*n* = 230)	35	15.2	112	15.4‡	9.0‡
Family history of skin cancer				11.6	/
Melanoma (*n* = 252)	15	6.0	92	/	1.1‡
NMSC (*n* = 245)	18	7.4	99	/	/
Personal history of skin cancer (*n* = 272)	70	25.7	70	2.3	1.6‡
Melanoma (*n* = 279)	35	12.3	63	/	0.5‡
BCC (*n* = 268)	30	11.3	74	/	/
SCC (*n* = 268)	9	3.4	74	/	/
Merkel cell carcinoma (*n* = 268)	3	1.1	74	/	/
T-cell lymphoma (*n* = 268)	1	0.4	74	/	/

†9.8% on total population had >40 nevi, number of missing data not known.
‡Number of missing data is not known.
§Solar lentigines in total were noted (not only on trunk).

Data collection and analyses

Patients were asked to fill in a questionnaire inquiring their reason for consult, demographic information and risk factors. Anxiety about skin cancer was questioned through a visual analogue scale (VAS) from 0 (no anxiety) to 10 (worst anxiety). During the appointment, a dermatologist examined the lesion(s) of concern and a TBE was completed. The dermatologist noted the clinical diagnosis of the lesion(s) of concern and documented clinical patient data. Suspicious lesions detected through TBE were also registered.

Results

Population characteristics

In a period of 24 months, 342 individuals qualified for an early-access lesion-directed dermatology consultation after triage by phone. Two hundred and ninety-seven patients, presenting themselves with 313 index lesions were included. When compared with a mean waiting time of 92.5 to 111 days at the University Hospital dermatology department, the early-access consultation allowed 43.5% of the patients to consult a dermatologist within 1 week, 25.4% within 1–2 weeks and 31.3% within 2–4 weeks. The mean age was 57 and the male/female ratio was 1 to 2. Most frequent reasons for consulting were ugly duckling sign (42.5%), a changed mole (36.2%) and advice by a physician (37%). Specific reason for consultation, referral and patient characteristics are summarized in Tables 1 and 2.

Patients were asked a set of yes/no questions concerning lesion characteristics. Multiple answers were possible. Of all patients who came on their own initiative ($N = 187$), 55.1% (103/187; 75 no answer) reported an ugly duckling lesion (different colour/shape/size/structure compared to other lesions), 64.2% (120/187; 42 no answer) reported a changing lesion, 11.2% (21/187; 86 no answer) had observed a non-healing lesion and 48.7% (91/187; 56 no answer) mentioned a new lesion.

Seventy-nine percent (200/254) of the patients indicated to have detected the lesion themselves; in 13.5% (34/254) the lesion was detected by the partner, in 3.2% (8/254) by a friend or family member and in 2.8% (7/254) by a physician.

Detection rates

In 79 patients, one of the index lesions was considered suspicious and 45 of these were histologically confirmed to be malignant, resulting in a minimum detection rate of 13.2% (45/342). Among detected skin cancers, 14 (4.1%) were melanoma, 18 (5.3%) BCC, 12 SCC (3.5%) and 1 T-cell lymphoma (0.3%).

After TBE 7, additional skin cancers (5 BCCs, 1 SCC and 1 melanoma) were detected in patients with a suspicious index lesion, whereas, only 1 additional skin cancer (BCC) was detected in patients with a benign index lesion, resulting in detection rates of 8.9% (7/79) and 0.5% (1/217), respectively.

Thirty seven percent (110 of 297) of the patients were advised or referred by a doctor (GP or non-dermatologist specialist) to seek dermatology advice for a specific lesion. In this group, skin cancer detection rate was 23.6% (26/110) of which 10 melanomas (9%), 7 SCC (6.3%) 9 BCC (8.1%)). This was significantly higher than in patients consulting without a doctor's advice or referral (23.6% versus 10.2%; Pearson χ^2; $P = 0.002$). Detection rates were also higher in patients with a personal history of skin cancer (70/272) compared to patients without a personal history of skin cancer (24.3% (17/70) versus 11.9% (24/ 201); Pearson χ^2, $P = 0.01$). Detection rate in patients consulting on their own initiative and without a personal history of skin cancer ($n = 115$), was 7.8% (9/115) compared to 21.3% (34/160) in the patients with a positive history or a physician's advice/referral (Pearson χ^2; $P = 0.003$). Detection rates in different risk subgroups are summarized in Table 3.

Among the lesions initially detected by patients themselves 17.6% (35/199) were malignant (17 BCC, 9 SCC, 9 melanomas); of those initially detected by the partner 8.8% (3/34) was malignant (3 melanomas) and in case the physician was the first to detect the lesion 1 in 7 (14.3%) was malignant (1 BCC).

Number needed to excise (NNE)

The number needed to excise (NNE) is defined as the total number of lesions that has been excised in order to identify one malignant lesion. Seventy-nine index lesions were considered clinically suspicious and were planned for excision or biopsy of which 45 were confirmed to be malignant, resulting in a NNE of 1.8. NNE for melanoma was 2.1 (14 of 29 confirmed), for SCC 1.4 (9 of 13 confirmed) and for BCC 1.2 (17 of 21 confirmed).

In patients with a suspicious index lesion ($n = 79$), further TBE resulted in 9 additional excisions of which 7 were confirmed malignant (NNE of 1.3). In contrast, additional TBE in patients with a benign index lesion ($n = 217$) resulted in 13 additional excisions of which only 1 malignant lesion confirmed corresponding (NNE of 13).

Table 3 Detection rates in patients with referral/advice by non-dermatologist or a personal history of skin cancer and in patients without a personal history of skin cancer or personal history of skin cancer

	Patients with history of skin cancer no. (%)	Patients referred/ advised to consult by non-dermatologist No. (%)	Patients without advice/referral and no personal history of skin cancer No. (%)
Diagnosis index lesion			
Malignant	17 (24.3)	26 (23.6)	9 (7.8)
Melanoma	3 (4.2)	10 (9.1)	2 (1.7)
SCC	4 (5.7)	7 (6.4)	3 (2.6)
BCC	9 (12.9)	9 (8.2)	4 (3.5)
Other malignant†	1 (1.4)	0 (0)	0 (0)
Benign	53 (75.7)	84 (76.4)	106 (92.2)
Total	70	110	115

†Cutaneous T-cell lymphoma.

Anxiety

Seventy-three percent (217/297) of the patients scored their anxiety about the index lesion(s) to be skin cancer at the beginning and the end of the consultation by means of a visual analogue scale (VAS). Mean VAS score decreased by the end of the consultation both in individuals in whom the index lesion was diagnosed benign (4.5 (95%CI: 4.1–4.9) to 0.9 (95%CI: 0.7–1.1) Paired-Samples *T*-Test, $P < 0.001$)) and in individuals in whom the index lesion was considered suspicious (4.3 (95%CI: 3.6–5.1) to 3.1 (95%CI: 2.4–3.9); Paired-Samples *T*-Test; $P = 0.003$; Fig. 1). While before start of the consultation VAS scores were similar, VAS scores after consultation were significantly lower in the group diagnosed with a benign lesion compared to the group diagnosed with suspicious lesion ($P < 0.001$). As a result, the mean change in VAS scores before and after consultation in patients with a clinically benign lesion dropped with 3.6 points compared to only 1.2 points when the lesion was considered suspicious ($P < 0.001$).

Discussion

In this study, we organized an early-access lesion-directed consultation for skin cancer detection after triage by using a telephone questionnaire. Overall, a minimum skin cancer detection rate of 13.2% was reached, which is 4 up to 6 times higher than

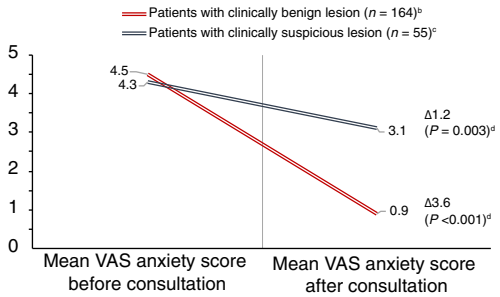

Figure 1 Anxiety levels before and after consultation in patients with suspicious or clinically benign lesions[a]. [a]Missing data: 78/297 did not provide VAS scores. [b]Benign lesions: management was noted as: no follow-up, follow-up or excision on patients' initiative. [c]Suspicious lesions: management was noted as: excision/biopsy on dermatologists' initiative. [d]Paired-Samples *T*-Test.

reported in population-based screenings and probably approximates detection rates in high-risk patients during surveillance. The Swiss Euromelanoma campaign reported a detection rate of 1.03% in 2017 ; the German SCREEN project reported an overall detection rate of 0.8% (0.2% for melanoma).[17,18] In our own population-based study detection rates were 2.4% (0.5% for melanoma) in the TBE group and 3.2% in the LDS group.[16] The American Academy of Dermatology reported a clinical diagnosis of skin cancer in 10.8% of the screeners and a confirmed diagnosis of melanoma in only 0.1% of the patients.[19,20] An important fraction of detected skin cancers were melanomas for which early detection has most to gain. The melanoma / NMSC ratio was 1 in 2 in our series versus 1 in 3 reported in other screening programs. [16,18] This distinction is most likely related to the criteria used for triage by phone, which were dominated by alerts for melanoma. The current study resulted a number needed to excise (NNE) of 1.8 which also favourably compares to other screening initiatives in population-based settings reporting NNEs varying from 1.8 up to 20.[16,20,21]

More than 1 in 5 patients had a personal skin cancer history and more than 1 in 3 patients were referred by a doctor. Detection rates in these subgroups were significantly higher {24.3% [4.2% melanoma] and 23.6% [9.1% melanoma], respectively}. However in the subgroup without personal history nor referral by a doctor, skin cancer detection rate was still 7.7% (1.7% for melanoma), which is at least 3 fold higher compared to other population-based screenings and has comparable melanoma/NMSC ratio. In case the index lesion was diagnosed benign the fear of having skin cancer had dropped significantly by the end of the consultation, reflecting value for the patient even in the absence of skin cancer detection.

Subsequent TBE in patients with a clinically benign index lesion resulted in a low additional detection rate (0.5%) while in patients with a suspicious index lesion additional detection rate was 8.9%. These data suggest that TBE after LDS approach is strongly advisable in case of a suspicious index lesion, but may be less (cost-)effective in case of a benign index lesion. The latter is also supported by our previous population-based LDS where TBE led to an additional detection rate of 0.3% in patients with a benign index lesion compared to 33% in patients with a malignant index lesion.[16] Argenziano et al. reported a risk of missing a skin cancer if not performing TBE of 2.17%.[22] However, this risk was higher if a skin tumour was the reason for consultation (OR 3.8) and upon presentation of a suspicious lesion in the problem/uncovered area (OR 6.8). These data suggest that when performing LDS – which we previously demonstrated to only take about 40 s of time – resulting in the diagnosis of a benign lesion one could omit additional TBE in the low-risk population. The latter would take about 3–4 additional minutes and bring a detection rate of around 0.5% (and a lot of unnecessary biopsies/excisions). Our data indicate that we rather spend time on other individuals worried about a specific lesion (detection rate of at least 7.7%).[23]

Efforts to increase sensitization around skin cancer recognition in the general population and/or the validation of specific checklists could further optimize preselection.[24,25] More specific in this study there was a higher educational level among participants compared to our population-based screening (Table 1: university degree among participants of 31.9% vs 10.8%). Furthermore, it needs to be noted that more than one third of the study population was advised by a physician, most often the GP, to consult a dermatologist. This stresses the importance of further involving and educating first line healthcare. Offering tools to the population that can help them preselect may be an attractive option to reach a more diverse population. Moreover these techniques may also be of value in case of long travel distances or infectious disease outbreaks such as the recent COVID-19 pandemic. Unfortunately at this moment existing smartphone applications using AI systems for diagnosis do not seem ready for such use in daily practice, although this field is rapidly evolving.[26–28] Teledermoscopy could offer another way to preselect specific lesions in need of early-access consultation.[29–33]

Conclusion

An early-access dermatology consultation for LDS after triage by phone resulted in high overall skin cancer and melanoma detection rates. Our data support that performing TBE is especially useful if the index lesion is suspicious.

In addition to surveillance programs in high-risk patients, LDS may be a way to optimize skin cancer detection and use available time more efficiently in daily dermatology practice.

Acknowledgements

We would like to thank the residents and study nurses of the dermatology department (University Hospital Ghent), Laure Lecluse, Ann Lambein, An Bosschaert and Prof. Hilde Beele as the head of the department for their support in this project. Lieve Brochez and Sofie Mylle had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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